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RAILROAD ACCIDENT REPORT

COLLISION OF ST. LOUIS - SAN FRANCISCO

RAILWAY TRAINS 3210 AND 3211

MUSTANG, OKLAHOMA

SEPTEMBER 1, 1974



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NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D.C. 20594
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ADOPTED: MAY 7, 1975

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16. Abstract On September 1, 1974, at 1:44 to 1:46 p.m., the St. Louis-San Francisco Railway Company's eastbound freight train 3210 and westbound train 3211 collided head-on 1.7 miles west of Mustang, Oklahoma. The trains were scheduled to meet in Mustang. However, train 3211 passed Mustang ahead of schedule. As a result of the collision, 4 locomotive units were destroyed, 23 cars derailed, and hazardous materials caught fire in the wreckage. As a result of the fire, eight families were evacuated from their homes. A brakeman on train 3211 was killed, and the three other crewmembers of that train were injured seriously. The National Transportation Safety Board determines that the probable cause of this accident was the failure of the crew of train 3211 to take preventive action after the train passed Mustang ahead of schedule. Contributing to the passing of the meeting point ahead of schedule were the engineer's and the conductor's erroneous assumptions based on radio transmissions from train 3210 that it was at a more distant point. The report contains recommendations addressed to the St. Louis-San Francisco Railway Company and the Federal Railroad Administration intended to prevent the recurrence of this type accident.			
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FOREWORD

The accident described in this report has been designated a major accident by the National Transportation Safety Board under the criteria established in the Safety Board's regulations. The report is based on facts obtained from an investigation conducted by the Safety Board in cooperation with the Federal Railroad Administration. The conclusions, the determination of probable cause, and the recommendations are those of the Safety Board.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20594

RAILROAD ACCIDENT REPORT

Adopted: May 7, 1975

Collision of St. Louis - San Francisco
Railway Trains 3210 and 3211
Mustang, Oklahoma
September 1, 1974

SYNOPSIS

On September 1, 1974, at 1:44 to 1:46 p.m., the St. Louis-San Francisco Railway Company's eastbound freight train 3210 and westbound train 3211 collided head-on 1.7 miles west of Mustang, Oklahoma. The trains were scheduled to meet in Mustang. However, train 3211 passed Mustang ahead of schedule. As a result of the collision, 4 locomotive units were destroyed, 23 cars derailed, and hazardous materials caught fire in the wreckage. As a result of the fire, eight families were evacuated from their homes. A brakeman on train 3211 was killed, and the three other crewmembers of that train were injured seriously.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the crew of train 3211 to take preventive action after the train passed Mustang ahead of schedule. Contributing to the passing of the meeting point ahead of schedule were the engineer's and conductor's erroneous assumptions based on radio transmissions from train 3210 that it was at a more distant point

FACTS

The Accident

Train 3211 -- The crew of train 3211 reported to work at the Oklahoma City, Oklahoma, yard office at about 12:45 p.m., Sunday, September 1, 1974. The crew was scheduled to operate the westbound train from Oklahoma City to Quanah, Texas, a distance of 184 miles. The engineer and conductor discussed their forthcoming trip and compared the times shown on their watches with each other and with the standard clock in the yard office. The times shown on the watches of the engineer and conductor varied less than 10 seconds from the standard clock. When the brakeman, who subsequently rode on the lead locomotive unit reported to work, he synchronized his watch with the standard clock.

Train 3211 was inspected and its brakes were tested before the train departed, and no irregularities were noted. In addition, the operation of the train's radio was checked. The Oklahoma City operator logged the train's departure as 1:15 p.m., the scheduled departure time. However, the conductor testified that the train actually departed at 1:18 p.m. The engineer, the conductor, and one brakeman rode in the lead locomotive unit; another brakeman occupied the cab of the second locomotive unit.

The train consisted of the 2 locomotive units, 23 loaded cars, 15 empty cars, and a caboose.

The train operated under the authority of a timetable schedule which designated train 3211 as a second-class train, superior to eastbound trains of the same class, such as train 3210. Train 3211 was scheduled to meet train 3210 at Mustang at 1:52 p.m. The first switching work for train 3211 was to be at Tuttle, 9 miles west of Mustang.

Train 3210 -- Train 3210 was an eastbound train between Quanah and Oklahoma City. Train 3210 departed Quanah at 8:30 a.m. on September 1, with an engineer and a brakeman in the first locomotive unit and a conductor and a brakeman in the caboose. When the crew reported to work at Quanah on September 1, they compared the times shown on their watches; the times on the watches compared within a few seconds of each other. Then, they compared the times shown on their watches with that shown on the standard clock at the station--there was about a 1-minute variation. The crew decided that their watches were correct since they had compared time with the standard clock at Oklahoma City the previous day. They did not reset their watches. The train was inspected and its brakes were tested before it departed Quanah and no irregularities were noted.

When the train reached Cyril, about 118 miles from Quanah, the conductor asked the operator to request from the dispatcher a train order to meet with train 3211 at Wheatland at 2:01 p.m. Wheatland is 9.8 miles west of Oklahoma City. The dispatcher denied the request and indicated that train 3211 would depart Oklahoma City on time. The engineer was informed of the dispatcher's decision and train 3210 departed Cyril at 12:20 p.m. with 2 locomotive units, 11 loaded cars, 6 empty cars, and a caboose. The train was stopped for about 2 minutes at a railroad crossing at Chickasha, 26.6 miles from Mustang. Train 3210 then proceeded.

Sometime between 1 p.m. and 1:10 p.m., the Oklahoma City yardmaster overheard a radio conversation between crewmembers of train 3210. The yardmaster informed some of the crewmembers of crew 3211 by radio that he had heard train 3210 in the vicinity of Chickasha attempt to contact the Chickasha operator by radio.

The collision -- A few minutes before the collision the engineer of train 3210 attempted to contact the crew of train 3211 by radio to determine the location of train 3211. The engineer of train 3211 could not understand the transmissions, but he subsequently advised by radio that train 3211 was passing Mustang and starting "down the hill." The engineer of train 3210 recognized the danger and shouted an alarm over the radio. When the crew of train 3210 sighted 3211, the engineer of train 3210 placed the brakes in emergency, and the crew evacuated. Train 3210 had almost stopped before the trains collided.

The engineer of train 3211 indicated that the incoming conversations on his radio were garbled. He sighted train 3210 about 400 feet from impact. He placed the train brakes in emergency, but the train's speed was not substantially reduced. The engineer and the conductor evacuated through the rear of the locomotive cab; the brakeman evacuated through the front door of the locomotive cab. The trains collided immediately after these three crewmembers had jumped.

The trains collided 1.7 miles west of Mustang. The crew of train 3210 indicated that the collision occurred at 1:44 p.m. The engineer and conductor of train 3211 stated that their train did not pass Mustang until 1:52 p.m. The brakeman, who was on the lead locomotive unit of train 3211, testified that his train passed Mustang at 1:50 p.m. and that he had called the time to the attention of the conductor.

As a result of the collision, the locomotives in train 3211 were destroyed and 23 cars derailed. A tank car which contained isobutane was punctured and its lading fueled a fire which was ignited in the wreckage. In addition to the isobutane, three tank carloads of JP-4 jet fuel also were consumed. Eight families who lived within 1 sq. mi. of the accident were evacuated from their homes. Because of the possibility of explosions, the wreckage was allowed to burn.

The engineer of train 3211 and the brakeman, who was riding in the trailing locomotive unit, could not be found immediately after the collision, and the burning wreckage hindered search efforts. About 5 p.m. on September 1, the engineer was found about 60 feet north of the track; he was seriously injured. Two days later, the body of the brakeman who had been in the second locomotive unit was found under the wreckage of the derailed cars.

Medical and Pathological Information

The crewmembers of train 3211 who jumped required hospitalization. The engineer suffered a fractured pelvis, arm, and ribs and a punctured lung. The conductor's ribs were fractured, and he suffered extensive third-degree burns. The surviving brakeman received a fractured collarbone, fractured vertebrae, and various other injuries.

The engineer of train 3210 was the only crewmember of that train who required hospitalization. His back was burned by the explosion that followed the impact.

The injured crewmembers were examined by medical personnel during their rescue and treatment. These examinations included observations for alcohol use or influence. None was detected. Blood tests to determine the presence of alcohol were not performed on the survivors. The autopsy of the brakeman revealed no traces of alcohol or barbiturates.

Accident Site and Method of Operation

The collision occurred on a single track 16.1 miles from Oklahoma City in a 2° curve to the left for westbound trains. The 2° curve started 1,040 feet east of the collision point and continued to 1,434 feet west of the collision point. There, the track became straight for 1,542 feet where another 2° curve began.

Beginning 0.8 mile west of Mustang, the track descended westward beyond the collision point at a rate of 0.94 percent. East of the collision point the descending grade averaged 0.8 percent; west of the collision site the grade averaged 0.9 percent for about a mile.

The curvature and terrain restricted visibility between the trains. Trains approaching could be seen from each other at a distance of about 2,000 feet, or 1,000 feet on each side of the impact point.

On the day of the accident, the temperature was about 80°F. and the sky was heavily overcast. Light rain had fallen about 1 p.m.

Trains were operated on the single, main track between Quanah and Oklahoma City by authority of timetables, train orders, and special instructions. The line was not equipped with automatic block signals except where it crossed other railroads.

In addition to the daily operation of trains 3210 and 3211, a second-class freight train operated westward on Sundays, Tuesdays, and Thursdays, and eastward on Mondays, Wednesdays, and Fridays. The maximum authorized train speed was 40 mph outside of the Oklahoma City yard limits. Within yard limits, which extended to Wheatland, trains were to proceed in accordance with rule 93, but trains were not to exceed 25 mph for 5.2 miles beyond the yard office. (See Appendices A and B.)

During the 3 months before the accident, trains 3210 and 3211 met by timetable authority 20 times, but only one time, on Sunday, August 18, at Mustang. In the 3-month period, trains 3210 and 3211 met by train order 72 times. Of these, the trains met at Mustang 10 times. The trains met by train order at Oklahoma City 19 times. (See Appendix B for train schedule.)

Rules which govern train meets are structured so that when a meet is made in accordance with timetable authority, the location of the meet may vary. (See Appendix A.) The rules require that an inferior train clear the time of a superior time by not less than 5 minutes. Thus, if an inferior train was operating behind schedule, it could be required to clear a superior train at some location before the inferior train arrived at the scheduled meet point. Likewise, a superior train could pass a scheduled meet point, but only after the scheduled meeting time had passed.

Train Equipment

The locomotives of both trains were manufactured by the Electro-Motive Division of the General Motors Corporation. The lead locomotive units were operated with the cab-end forward, and the trailing units had the cab-ends rearward. The lead unit on train 3211 was a Model GP-38, and the trailing unit was a Model GP-7. Both locomotive units of train 3210 were Model GP-38's. The locomotives were equipped with radios, speed recorders, and tapes to record speeds permanently.

The consist of train 3211 included 15 tank cars of JP-4 jet fuel and the 1 tank car of isobutane. The caboose was equipped with a radio.

The consist of train 3210 included one tank car of gasoline. The caboose of this train also was equipped with radio.

Damages

On impact, the lead locomotive unit of train 3211 climbed over the lead locomotive unit of train 3210, veered to the right, and turned 180°. It came to rest in a ditch on the north side of the track and was essentially intact. The frame was bent and the fuel tanks and running gear had been stripped from it. The trailing locomotive unit veered to the left and came to rest in the ditch on the south side of the track. The unit was essentially intact but the generator and engines were dislodged and the undercarriage and fuel tanks were stripped. Nineteen of the 23 derailed cars in train 3211 were involved in the fire that ensued.

Only the front trucks of the lead locomotive unit of train 3210 derailed; however, the entire superstructure was demolished. Although the trailing locomotive unit of that train did not derail, its superstructure also was destroyed.

The railroad estimated the cost of the accident as follows:

Lading	\$100,000
Car equipment	246,000
Locomotives	868,924
Track	8,000
Cleanup	73,571
Damage to adjacent property	<u>1,000</u>
Total	\$1,297,495

Traincrew

Most of the crewmembers were longstanding employees who were familiar with the track where the trains collided; however, the two brakemen on

train 3211 were not experienced with the operation of trains 3210 and 3211. (See Appendix C.)

Rescue Activities

After the collision, the rear brakeman of train 3210 returned to the caboose and radioed the Oklahoma City operator. The operator then advised the Oklahoma City Police Department dispatcher of the wreck and gave them information on the hazardous materials involved. After talking to the police dispatcher, the operator looked at the standard clock and noted it was 1:50 p.m. The police department's call card was stamped 1:54 p.m.

The Oklahoma City Fire Department received independent notification of the accident. This call was logged at 1:52 p.m.

An off-duty Mustang police officer noticed the black smoke from the burning wreckage and then noted the time as 1:45 p.m. The Mustang Police Department received several calls advising of the accident. The time of the calls was logged at 1:49 p.m. Various other rescue units went to the scene. The times that these units were sent were logged at 1:54 and in two instances at 2:00 p.m.

Rescue personnel arrived promptly. Because of the hazardous materials rescue personnel decided to let the cars burn and to evacuate the area. A locomotive was dispatched from Oklahoma City to pull the cars of train 3211 that did not derail back from the burning wreckage. Rescue personnel concentrated their efforts on the search for the missing crewmembers.

Two bystanders assisted the injured brakeman of train 3211 from the wreck and into a vehicle to take him to a hospital. These bystanders indicated that the brakeman stated repeatedly, "I told them that we were too early."

Tests and Research

As a result of the destruction of the locomotives, the recording tapes in the speed recorders were destroyed. The controls of the lead locomotives of train 3210 also were destroyed. The controls of the lead locomotive of train 3211 were discovered with the brakes in full release, the throttle in full open, and the reverser lever in the forward position.

A railroad supervisor found nine unopened beer cans in the cab of the lead locomotive unit of train 3211. He also found two 6-pack beer cartons. A 10th unopened can of beer was found crushed under the locomotive of 3211 during the salvage operation. The beer cans were examined for fingerprints by the FBI, but no latent prints could be identified. The crewmembers denied bringing the beer into the locomotive cab and could not recall how it got there. Rule G prohibits the possession of alcohol.

After the accident, the brakes on the cars in train 3210 were tested. The tests indicated that piston travel and air leakage were within allowable limits. Those cars of train 3211 that were pulled back from the wreckage were dispatched as part of another train on September 3, 1974. Although brakes on these cars were not inspected as a result of the accident, the brakes were later inspected as part of an initial terminal air brake test. No exceptions were noted. Because of the extent of the damages to the derailed cars, it was not determined if the brakes were operable.

At the request of the Safety Board, the Westinghouse Air Brake Company computed the stopping distances for trains similar to 3210 and 3211 and operating under similar circumstances. For an assumed speed of 35 mph, the stopping distance of train 3211 with emergency brakes applied was calculated to be 927 feet. For the same consist train with an initial speed of 40 mph, the emergency stopping distance would be 1,232 feet. For train 3210, the emergency stopping distance from a speed of 35 mph would be 706 feet and from a speed of 40 mph, would be 922 feet.

ANALYSIS

The Time of the Collision

Critical to the determination of cause is the time at which the collision occurred. The statements of the engineer and conductor of train 3211 that they passed Mustang at the schedule time of 1:52 were disputed by the surviving brakeman of that train and by all of the crew of train 3210, and conflicted with the time the report of the accident was noted by the Oklahoma City operator, the off-duty Mustang police officer who saw the smoke of the wreckage, and the records of the rescue units that were first summoned to the scene. The only reports that were consistent with train 3211's passing Mustang at 1:52 p.m. were the 2:00 p.m. calls logged by two rescue units. Thus, the preponderance of evidence indicates that train 3211 passed Mustang ahead of schedule.

According to the crew of train 3210, the trains collided at 1:44 p.m. Time-distance calculations were made for the routes traversed by both trains to determine if this schedule was possible. For train 3211 to have been at the collision point at 1:44 p.m., it would have been necessary for the train to depart Oklahoma City at 1:15 p.m. It then would have had to traverse the 5.2 miles of yard track that is restricted to a maximum speed of 25 mph at that speed, and the balance of the distance to the collision point at the maximum authorized speed of 40 mph. Based on these calculations, it was possible for the collision to have occurred at 1:44 p.m.

However, time-distance calculations also were made on the basis of the testimony of the engineer and conductor of train 3211. These crewmembers estimated their speed at various locations during the trip. Based

on the fastest speeds estimated for the various locations and assuming that the train departed at 1:18 p.m., as indicated by the conductor, the earliest possible arrival time at the collision point would have been 1:56 p.m. Based on the slowest speeds estimated by these crewmembers and also assuming a 1:18 p.m. departure, the arrival time at the impact point would have been 2:04 p.m.

Train 3210 departed Cyril at 12:20 p.m. as indicated by the Cyril operator and the conductor. Time-distance calculations for the 49.4 miles to the accident site indicated that it was possible for that train to arrive at 1:46 p.m. by complying with all speed restrictions and stopping for the railroad crossing at Chickasha.

Train 3211

The engineer and conductor of train 3211 apparently were not concerned when they passed Mustang ahead of schedule. Based on available evidence, the brakeman's statement that he warned the conductor that they were ahead of schedule is considered credible.

It is unlikely that the engineer and conductor were not aware that Mustang was the scheduled meet point. Both were familiar with the territory and the engineer had participated in a scheduled meet between trains 3210 and 3211 at Mustang just 2 weeks before the collision. Both the brakeman and conductor stated that the conductor was looking at his timetable as the train passed Mustang; therefore, the Safety Board believes the decision to continue was made after some deliberation.

Although the infrequency of meets at Mustang may have influenced the conductor's decision to continue, the Safety Board believes that the major influence was the conversation between the Oklahoma City yardmaster and the crewmembers of train 3211 concerning train 3210's location. The yardmaster stated that he told the engineer of train 3211 by radio that he had overheard a radio transmission made by the crew of 3210 in the vicinity of Chickasha. The conductor's testimony best describes his interpretation of that conversation.

"(The yardmaster) said they are trying to come over on the radio. They are over the other side of Chickasha. Well, that's the only place you can get Oklahoma City is between Laverty and Chickasha. That's when they are up on the mountain."

The conductor testified further.

"When (the yardmaster) told me that he was over the other side of Chickasha, I didn't even dream he would come to Mustang. That was the last thing in my mind. He didn't have time to come to Mustang."

Thus, based on the above information, the Safety Board believes that the conductor of train 3211 thought there was no way possible for the trains to meet at Mustang. However, his determination of the location of train 3210 based on the radio reception was inaccurate. Under normal weather conditions such determinations may have been made correctly; however, on the day of the accident it was heavily overcast and raining which can extend the range of radio transmissions.

A further insight was provided when he testified at another point: "Well...we had no meeting point...I was the superior train. I was the westward train. I'm the big dog. They are clearing me. They come as far as they can come to clear me and still take a siding. We don't have a meeting point any place."

The crew of 3211 knew that train meets at Mustang were rare. They also knew, or thought they knew, the locations from which radio transmissions could be heard. However, the assumption that a train meet would not occur at Mustang on the basis of this information was not justified. In any event, under no circumstances can there be justification for passing a scheduled meeting point ahead of time.

Train 3210

At a collision time of 1:44 to 1:46 p.m. the crew of train 3210 was on the verge of violating established meet procedures also. Train 3210 was required to be in the clear at Mustang at 1:47 p.m., 5 minutes before the scheduled meet time. The train could not have moved from the collision point to Mustang, stopped to allow a crewmember to open the switch, and pulled onto the siding in the time available. However, they could have cleared train 3211 in advance of the scheduled meet time at Mustang.

The crew of train 3210 relied on the crew of train 3211 to comply with the rules. At the same time, the crew of train 3210 was about to "stretch" a rule. Thus, their reliance for safety upon exact rule compliance by the crew of train 3211 was inconsistent rationale.

Operating Rules

Although the accident resulted from a rule violation, the system was intended to accommodate some human failures. Yet, the safeguards provided in some operating rules were not consistent with the structure of other similar rules. For example, rule 3(b) required that the crewmembers of a train moving against the schedule of a superior train compare time before passing the last station before the point where the inferior train was to clear the superior train. However, the rules did not require the crewmembers of the superior train to compare time before passing a scheduled meet point.

Rule S-89 required inferior trains to clear superior trains by 5 minutes, which safeguarded the operations of inferior trains. Rule 92 states that a train must not leave a station in advance. The safeguard in the instance of a superior train was apparently lodged in rules 14(n) and S-90.

Rules 14(n) and S-90 required whistle signals to be sounded on approach to meeting points. Presumably, these whistle signals would alert the crewmembers who were not riding in the locomotive that the engineer was aware of the approaching restriction. However, there was no rule requiring the cab occupants to communicate this same information to each other. Currently, trains are so long that a whistle signal may not be heard in the caboose. Yet, rule S-90 requires crewmembers to take immediate action to stop the train if the engineer fails to give this signal. The rule was incompatible with the current operations because the intended recipient might not hear the signal in all instances and, thus, fail to take action.

Radio Use

Although modern-day train length has out-dated whistle signals as a means of communication between the locomotive and the caboose, radio communication between the head-end and the rear-end of a train existed. However, there were no rules governing its use. The radio was used only at the discretion of individual crewmembers, which varied. The reasons for the promulgation of safeguards such as rules 14(n) and S-90 still exist when trains are scheduled to meet on single track lines. It seems that the radio could be used effectively to remind other crewmembers that a meet is contemplated; however, the specific methods and circumstances are not described in current rules and the ranges over which such communications can be reliably used have not been set forth.

Similarly, radio contact between opposing trains could be another safeguard if the circumstances for its use were exactly set forth. The radio provided the first warning of the impending collision to the crew of train 3210 and the entire crew survived without serious injury. If radio contact had been successfully established earlier, the collision might have been averted even though train 3211 passed Mustang ahead of schedule. The radio contact was happenstance. It was not required by railroad management, but was made because of concern by the engineer of train 3210.

The use of the radio in this instance may have saved lives when the collision was imminent, but it also contributed to an erroneous assumption by the engineer and conductor of train 3211 regarding the location of train 3210. It modified their perception of the train's location to the extent that they ignored rule 92.

On the other hand, the information was unofficial, not subject to any communication standards, and, therefore, not reliable. There were no checks to verify that the message had been received properly and understood. Even if the message had been properly transmitted directly to the crew of train 3211, it would not have authorized train 3211 to pass Mustang ahead of 1:52 p.m. Thus, radio can promote safety and advance operations, but only if it is used with the same safeguards intended in the operating rules.

In 1972, the Safety Board first made recommendations to the Federal Railroad Administration (FRA) for the promulgation of radio regulations. 1/ In 1975, the Board reemphasized the problems with radio use in its investigation of an accident that occurred on the Penn Central in Cleveland, Ohio. 2/ The Mustang collision provides another example of the need for regulations that prescribe the use of radio in railroad operation. To date none have been promulgated.

Locomotive Cab Management Procedures

This accident is another in a long list where the presence of other crewmembers in the cab of a locomotive did not prevent improper action by the engineer. In this instance, the young brakeman in the lead locomotive unit of train 3211 was aware that his train passed Mustang ahead of schedule. He thought that he fulfilled his responsibility when he told the conductor of this. Railroad management stated after the accident that the brakeman should have stopped the train when he realized that they were passing Mustang ahead of schedule. Perhaps the brakeman's failure to do so was related to the subordinate/supervisor and the junior/senior relationships between the brakeman and the conductor.

These are complex problems which cannot be solved by merely stating that a brakeman must take immediate action to stop the train in an emergency as was done in rules 106 and 801. The brakeman had not been trained sufficiently to realize that such was the intent of rules 106 and 801 when train 3211 passed the meet point ahead of schedule. He did not realize the seriousness of the act until train 3210 was visible.

The Timetable Schedule

Trains 3210 and 3211 met by authority of the timetable in only 20 instances in the 3 months preceding the accident, but they met by train order authority 72 times. This suggests that the unpredictable performance of these two trains was not conducive to a schedule. The effect of using timetable authority to accomplish meets at stations other than

1/ National Transportation Safety Board Recommendation R-72-9 dated April 19, 1972.

2/ National Transportation Safety Board Railroad Accident Report - Collision of Penn Central Freight Train OV-8 with an Open Drawbridge, Cleveland, Ohio, May 8, 1974; NTSB-RAR-75-3.

Mustang was to transfer the decisionmaking from the dispatcher to the conductor of the inferior train. This function probably could be better performed by the dispatcher, who should have available information on all trains, not just one. The means for accumulating the necessary information for the dispatcher's use may also exist with the active use of the radio as a formal part of the system.

The circumstances suggest that the collision might not have occurred if the meet at Mustang had been scheduled by train order rather than by timetable. The location of train 3210 at the time of 3211's departure from Oklahoma City then would have been of no consequence to the crew of 3211 as they would have been required to wait at the location designated by train order.

It is also significant that the scheduled meet for trains 3210 and 3211 was only 37 minutes after train 3211's scheduled departure. This, and the fact that 19 of the 92 meets between trains 3210 and 3211 before the accident were at Oklahoma City, should have suggested to management that the trains might not have to meet after departing from their terminals.

CONCLUSIONS

1. The times indicated by the watches of the respective crewmembers of trains 3210 and 3211 probably agreed within prescribed limits even though the crew of 3210 did not set their watches to conform with the standard clock at Quanah, which evidently was in error.
2. The crew register procedures at Oklahoma City did not assure compliance with rule G since beer was discovered in and around the locomotive of train 3211 after the collision.
3. The braking systems of trains 3210 and 3211 were functioning normally before the collision.
4. The dispatcher knew the location and work schedule of train 3210 about 1 hour before train 3211's departure, but he did not transmit this information to the crew of train 3211.
5. The overcast weather conditions on the accident date allowed radio transmissions to be heard beyond their normal range.
6. The engineer and conductor of train 3211 believed that train 3210 was farther from them than it actually was because of their past experience with sporadic radio transmissions from the Chickasha area.
7. Both trains were moving about 40 mph as they approached the collision. The trains had operated at about the maximum authorized speeds since their respective departures from Oklahoma City and Cyril.

8. The conductor of train 3211, after deciding to proceed, failed to heed the warning of the brakeman that they were passing Mustang ahead of schedule.
9. The radio conversation between the crews of both trains alerted the crew of train 3210 of the impending collision and allowed them to brake their train and evacuate without serious injury; however, the radio transmission from the engineer of train 3210 was not understood by the crew of train 3211, and they did not take immediate action.
10. The crew of train 3211 did not immediately recognize the approach of train 3210; however, if the emergency brakes had been applied on train 3211 when the other train was first visible the collision would still have occurred, but at a slower speed.
11. The collision occurred at about 1:44 to 1:46 p.m., 6 to 8 minutes before train 3211 was authorized to pass Mustang.
12. The intended margin of safety of the rules was not produced by the crew of train 3210 since they would not have had sufficient time to clear train 3211 at Mustang by 5 minutes as required; however, they had time to clear train 3211 before that train's scheduled departure from Mustang.
13. Although the procedures specified by rules 14(n), 34, S-90, 106, and 801 were designed to prevent a train such as 3211 from passing Mustang ahead of schedule, they were non-specific, outmoded, not followed, and therefore ineffective in preventing this collision.
14. Although trains 3210 and 3211 were controlled by a timetable schedule, they seldom operated on schedule, which suggests that another method of operation may have been more appropriate for the circumstances.
15. Before the accident, neither the railroad nor Federal authorities had prescribed the exact role intended for the use of radio in facilitating train movements.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the crew of train 3211 to take preventive action after the train passed Mustang ahead of schedule. Contributing to the passing of the meeting point ahead of schedule were the engineer's and the conductor's erroneous assumptions based on radio transmissions from train 3211 that it was at a more distant point.

RECOMMENDATIONS

The National Transportation Safety Board recommends that the St. Louis-San Francisco Railway Company:

1. Enforce the exact requirements of the operating rules and establish a more effective system to insure that employees understand them. Particular emphasis should be given to the problems demonstrated in the application of rules G, 3, 3(b), 14(n), 34, S-87, S-89, S-90, 92, 106, and 801 in the circumstances of this accident. (Recommendation R-75-25)
2. Promulgate operating rules that provide specific guidance for the use of radio in railroad operations. (Recommendation R-75-26)
3. Revise its operating rules that pertain to train meeting procedures so that the rules are consistent with current operating conditions as to the meeting of schedules and so that they provide safeguards for the crews of both trains. (Recommendation R-75-27)

The Safety Board reiterates and emphasizes the importance of the following recommendations made in previous accident reports which have not been implemented and are applicable to this accident:

Safety Recommendation R-72-9 forwarded to the Administrator, Federal Railroad Administration on May 17, 1972:

"That the Federal Railroad Administration (FRA) issue as soon as possible regulations to provide for the use of radio in railroad operations. These regulations should include the traditional safeguards found in existing railroad operating rules where they apply to train movements. It is further recommended that, in drafting such regulations, consideration be given to the principles and procedures for radio used by military and civilian aviation authorities." (Recommendation R-72-9 adopted April 19, 1972)

Railroad Accident Report NTSB-RAR-75-3, Collision of Penn Central Freight Train OV-8 with an Open Drawbridge, Cleveland, Ohio, May 8, 1974:

"That the FRA require that railroads institute formal locomotive cab management procedures which will specify the duties of each crewmember to ensure the crew action required when the engineer does not function in a manner consistent with the safety of the train. These procedures should be integrated with the results of the ongoing FRA/industry locomotive-cab design project." (Recommendation R-75-15 adopted March 26, 1975)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

May 7, 1975

APPENDIX A

Excerpts from the Frisco's "Rules of the
Transportation Department."

G. The use or possession of intoxicants or narcotics is prohibited.

TIME TABLE

Time Table: The authority for the movement of regular trains, subject to the rules. It contains classified schedules with special instructions relating to the movement of trains.

Schedule: That part of a time table which prescribes class, direction, number and movement for a regular train.

NOTE: Number may be designated by numerals and/or alphabetic letters.

Special Instructions: Where this term is used it refers to Special Instructions in time table.

3. Where standard clocks are available, watches of conductors, enginemen, main track hostlers and engine foremen, must be compared with a standard clock before commencing each day's work or trip. The time when watches are compared must be registered on a prescribed form and indicate seconds fast, or slow, or if watch set.

3(a). Conductors, enginemen, main track hostlers, engine foremen and train order operators, whose duties preclude access to a standard clock, must obtain time from dispatcher, or compare and regulate their watches daily with those of conductors or enginemen who have standard time and have registered as provided.

3(b). Conductors, or engine foremen, and enginemen must compare time with each other before commencing each day's work or trip, and with their brakemen and firemen as soon thereafter as practicable. When moving against the schedule or time of an opposing superior train, the enginemen will compare time with the fireman and, when possible, with trainmen, the conductor will, when practicable, compare time with one or more brakemen, before passing the last station preceding the point where the inferior train is to clear a superior train.

5. Not more than two times will be shown for a train at any station. Where one is shown, it is, except at terminating stations, the leaving time; where two, they are the arriving and leaving times.

The time applies at the switch where an opposing train enters the siding; where there is no siding, it applies at the place where fixed signals are operated; where there is neither siding nor fixed signal, it applies at the station.

Trains scheduled to receive or discharge passengers or U. S. Mail must not leave the point where such traffic is received or discharged before time shown in schedule.

Scheduled meeting or passing stations are indicated by figures in full-faced type, with the numbers of the trains to be met or passed in small figures adjacent.

Both the arriving and leaving time of a train are in full-faced type when both are meeting or passing times, or when one or more trains are to meet or pass it between those times.

When trains are to be met or passed at a siding extending between two adjoining stations, the time at each end of the siding will be shown in full-faced type.

Sound	Indication
(n) — — o	Approaching point where restricted for another train.

APPENDIX A

34. All members of train and engine crews must, when practicable, communicate to each other the indication displayed by each signal affecting the movement of their train. Indication of such signal must be called by member of train or engine crew who first observes such signal, and must be called by other members of crew when signal is observed by them. When train man is in engine cab he will station himself where he can observe signal.

A proceed signal indication may be changed to display stop before it is reached and engine men and train men must be on the alert to observe it. Such occurrences must be reported to chief dispatcher.

SUPERIORITY OF TRAINS

S-71. A train is superior to another train by right, class or direction.

Right is conferred by train order; class and direction by time table.

Right is superior to class or direction.

Direction is superior as between trains of the same class.

S-72. Train in the direction specified by the time table are superior to trains of the same class in the opposite direction.

S-87. An inferior train must keep out of the way of opposing superior trains, and failing to clear the main track by the time required by rule must be protected as prescribed by Rule 99.

Extra trains must clear the time of opposing regular trains not less than five minutes unless otherwise provided, and will be governed by train orders with respect to opposing extra trains.

Trains over which an extra train is given right, and for which the extra train is waiting, must clear the time of the extra train at least five minutes.

S-89. At meeting points the inferior train must take the siding and, except at train order meeting points, clear the time of the superior train not less than five minutes.

The inferior train must pull into the siding when practicable. If necessary to back in, it must be protected as prescribed by Rule 99.

S-90. On trains equipped with communicating signal system the conductor must give signal 16(l) to the engineman immediately after passing the last station preceding a point where restricted for another train. The engineman will immediately reply with signal 14(n). If the train is to take siding the conductor will immediately repeat signal 16(l) and the engineman will repeat signal 14(n).

Should engineman fail to answer by signal 14(n), or fail to prepare to stop short of fouling point, when required, immediate action must be taken to stop the train. The failure of the communicating signal system does not relieve the engineman of his responsibility in observance of Rule 14(n).

On trains not equipped with communicating signal system the engineman will give signal 14(n) at least two miles before reaching a point where restricted for another train. If the train is to take siding the engineman will repeat signal 14(n) at least one mile before reaching the switch where required to enter the siding.

Should engineman fail to give this signal or fail to prepare to stop short of fouling point, when required, immediate action must be taken to stop the train.

5-90(a). At meeting points the train holding main track will, if it arrives first, open the switch, if practicable, for the opposing train to take siding; but this in no way relieves the train which is to take siding from being prepared to stop to open switch. The employee who opens the switch must protect it unless relieved by another train man.

92. A train must not leave a station in advance of its schedule leaving time.

93. Within yard limits the main track may be used, clearing first class trains as prescribed by the rules. Protection against second and third class trains and extra trains is not required. Second and third class trains and extra trains must move within yard limits prepared to stop short of train, obstruction, or anything that may require the speed of a train to be reduced.

RESPONSIBILITY OF TRAIN MEN AND ENGINE MEN

106. Conductors and enginemen are responsible for cooperation between all members of the crew.

Both the conductor and the engineman, or anyone acting as pilot, are responsible for the protection and safety of the train and the observance of these rules, and, under conditions not provided for by the rules, must take every precaution for protection.

The general direction and government of a train is vested in the conductor and all persons employed on the train must obey his instructions. Should there be any doubt as to authority or safety of proceeding from any cause, the conductor must consult the engineman and be equally responsible with him for the safety and proper handling of the train.

Engineman is jointly responsible with the conductor for the safety of the train and proper observance of these rules and, although they are under the direction of the conductor regarding the supervision of train, they will not comply with any instructions which imperil the safety of the train or involve a violation of rules or law.

Conductors and enginemen must see that their subordinates are familiar with their duties, ascertain the extent of their experience and knowledge of the rules and instruct them, when necessary, in the proper and safe performance of their work and caution them as to its risk. Disobedience and incompetence must be reported.

When on duty, brakemen and porters are subordinate to conductors, firemen are subordinate to engineers and switchmen are subordinate to engine foremen.

When the conductor is not present, train men must promptly obey the instructions of the engineman relating to the safety and protection of the train.

Train men and firemen, after carefully reading train orders, must keep them in mind and assist in their observance, call attention of conductor or engineman immediately to any apparent failure to observe train orders, clear the time of superior trains or to comply with rules and instructions.

When safety of trains and observance of rules or train orders are involved, train men and firemen are responsible to the extent of their ability to prevent accident or violation of rules. They will not comply with any instructions which imperil the safety of the train or involve a violation of rules.

When the conductor or engineman fails to take action to stop the train, and an emergency requires, brakemen, firemen and yardmen must take immediate action to stop the train.

801. Employees whose duties are connected with the movement of trains, engines or cars, must familiarize themselves with the rules governing the duties of others as well as themselves and must be prepared, in case of emergency, to act in any capacity to insure safety.

1111. Radio communication system does not modify or supersede any rule of the Transportation Department or special instructions. Communication via radio on trains and engines must not be utilized in any manner that would have the effect of supplanting or modifying strict compliance with operating rules and special instructions.

APPENDIX B

Timetable Schedule

10 CHICKASHA SUB—SOUTHWESTERN DIVISION

WEST		Miles	STATIONS	Station Number	TPI	Track Cap.			EAST	
Second Class						Sidings			Second Class	
3213 Leave Su. Th.	3211 Leave Daily					Cars	Feet	Aux.	3210 Arrive Daily	3212 Arrive Mo. Wd. Fr.
PM	PM		RTCOB EYO	G540	OC			Yd	PM	PM
930	115	539.5	OKLAHOMA CITY						230	630
		542.8	A.T.S.F.							
			11.1							
1107	152	553.9	MUSTANG	G554	US	85	4293	24	152	353
			8.9							
1130	203	562.8	TUTTLE	G563	TT			75	1257	333
			4.7							
1140	209	567.5	SOONER	G567	UT	102	5108		1250	321
			13.0							
		580.5	O.R.I.P.							
			0.3							
AM										
1230	227	580.8	CHICKASHA	G581	CC	43	2197	139	1227	258
			6.1							
1240	236	586.9	NORGE	G587		34	1745		1201	236
			12.6							
101	3212	599.5	CEMENT	G600		37	1856	15	1144	3211
	255		5.5							155
140	315	605.0	CYRIL	G605	CR	73	4000	211	1135	101
			5.6							
150	325	610.6	FLETCHER	G611	TC	89	4459	28	1055	1148
			4.0							
200	332	614.6	ELGIN	G615	EG	31	1597	26	1047	1143
			10.9							
215	350	625.5	FORT SILL	G626	FI	39	1954	76	1030	1125
			4.2							
		629.7	O.R.I.P.							
			0.5							
230	401	630.2	LAWTON	G630	LT			Yd	1020	1101
			13.7							
AM	430	643.9	CACHE	G644	EZ	88	4445	35	947	
			20.2							
		664.1	ENID SUB.							
			0.3							
	517	664.4	SNYDER	G664	SN			Yd	917	
			11.6							
									900	
	535	676.0	HEADRICK	G676	HK	41	2069	23		
			10.6							
		686.6	M.K.T.							
			0.6							
	601	687.2	ALTUS	G687	AS	33	1695	Yd	840	
			0.9							
		688.1	A.T.S.F.							
			7.4							
	615	695.5	OLUSTEE	G695	OU	31	1573	44	825	
			13.9							
	635	709.4	ELDORADO	G709	ED	31	1585	116	806	
			13.9							
	700	723.3	QUANAH	G723	QU			Yd	745	
			183.8							
									AM	
Arrive Mo. Wd. Fr. 3213	Arrive Daily 3211	Westward trains are superior to eastward trains of the same class.							Leave Daily 3210	Leave Mo. Wd. Fr. 3212

MAXIMUM SPEED	49
(except as noted)	
MP 639-25 to MP 544-25	25
544-25	40
Over Bridge 557.9	30
Until engine thru limits	
MP 580-15 to MP 582-11	20
628-31	25
686-10	30
688-3	20

Move at restricted speed on C.R.I.P. tracks Oklahoma City, Fort Sill & Lawton.

Trains will use Q.A.P. tracks between Red River and Quanah. SL-SF rules will govern.

HOT HOX DETECTORS

@ # MP 590-28
@ # 684-10
No. 3211 will register at Lawton, Oklahoma.
Bridge class of engines and foreign derricks 53
Yard Limits: Oklahoma City to Wheatland

APPENDIX C

Crew Information

Train 3211 -- The conductor of this train had been employed as a trainman since 1941. He had made 18 round trips on trains 3210 and 3211 in the 3 months preceding the accident.

The engineer of train 3211 had been employed since 1941 and had been promoted to an engineer in 1945. He had made 2 round trips on trains 3210 and 3211 in the 3 months preceding the accident; one of these was on August 18 when train 3210 met 3211 at Mustang in accordance with the timetable schedule. He had worked 15 years in this particular territory.

The brakeman that rode the lead locomotive unit of train 3211 had been employed in yard service in 1969. He had transferred to road service as a brakeman about 3 months before the accident. He had made 3 round trips on trains 3210 and 3211, all of which had been in the 8 days preceding the accident. He had received no formal training or examination on the duties of a road brakeman. He had learned these duties on the job under the supervision of conductors and engineers, which is the practice on the Frisco. He had attended a rules meeting last on May 20, 1974.

The brakeman who rode the trailing locomotive unit of train 3211 had been employed in 1973 as a brakeman. He had made one round trip on trains 3210 and 3211 in the 3 months prior to September 1. He had been examined on the rules in 1973 and had last attended a rules meeting on April 9, 1974.

Train 3210 -- The conductor had been employed as a trainman since 1941 and had been promoted to conductor in 1947. He had made 24 round trips on trains 3210 and 3211 in the 3 months before the accident.

The engineer had worked for the railroad since 1937 and was promoted to engineer in 1947. The engineer had worked on trains 3210 and 3211 during 18 round trips in the 3-month period prior to the collision.

The brakeman who was riding in the locomotive of train 3210 had worked as a brakeman since 1950. He had been promoted to conductor in 1960 and he had been on trains 3210 and 3211 on 17 round trips since June 1, 1974.

The brakeman who rode in the caboose of train 3210 had worked as a brakeman since 1948, having been promoted to conductor in 1951. He had worked on trains 3210 and 3211 on 24 round trips since June 1, 1974.

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